

Monitoring the Training Process in Women's Soccer (Football)

Thesis submitted for the degree of Master of Arts in Sport Studies (Research)

to

University of Technology, Sydney

Faculty of Business

Helen Alexiou
2008



CERTIFICATE OF AUTHORSHIP/ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Student

Hilixion

Acknowledgments

The completion of this thesis was only possible with the support of the following people.

Firstly, I would like to thank my supervisor Dr Aaron Coutts. Your enthusiasm, support, advice, understanding and flexibility have been fantastic and you have provided me with a positive experience, which I'll always appreciate. Thank you for being a great supervisor in every sense of the role.

I would also like to thank the following people for their support throughout the project.

- Maria Nute and Emma Stevenson for their support with the laboratory testing. Thank you.
- Siobhan Chamberlain and Judith Oakley for their assistance with the data collection, Thank you.
- Rhona Blair and Mike Perebryne for their assistance with the testing equipment. Thank you.
- Lois Fidler, Mo Marley and Dawn Scott at the FA Womens National Player Development Centre for their support and willingness to be part of the project. Thank you.
- The players at the National Player Development Centre who participated in the assessments carried out during the studies. Thank you.
- Ray Ashley for his support, understanding and willingness to think outside the box. Thank you.

Finally, I would like to thank my partner Gavin Hinten for your incredible support, understanding and patience. Your support has been amazing and I'm very lucky to have had you there. Thank you.

Table of Contents

Monitoring the Training Process in Women's Soccer (Football)	i
CERTIFICATE OF AUTHORSHIP/ORIGINALITY	i
Acknowledgments.....	ii
Table of Contents	iv
List of Illustrations and Tables	vii
Abstract	viii
Keywords.....	xi
List of Abbreviations	xii
 Chapter 1.....	 1
Introduction	1
Background	2
<i>Training and Playing Demands of Soccer</i>	2
<i>Monitoring Training</i>	4
<i>Methods for Monitoring Internal Training Load</i>	5
<i>Session-RPE method for Quantifying Internal Training Load</i>	7
<i>Summary</i>	12
Research Problem	12
Aims of the Research	14
<i>Objectives</i>	14
<i>Hypotheses</i>	16
Contribution to Theory and Practice	17
Limitations and Assumptions	19
<i>Subject compliance</i>	19
Delimitations	20
<i>Sample size</i>	20
<i>Subjects</i>	20
References	21
 Chapter 2.....	 25
Literature Review	25
Introduction.....	26
Characteristics Associated With Performance in Soccer	27
The Training Process.....	31
Monitoring Athletes Training Loads	33
<i>The importance of monitoring training and training load</i>	33
<i>Heart rate-based methods for monitoring training load</i>	35
<i>Alternative method for monitoring training load</i>	38
The Practical Application of the Session-RPE-Method in Monitoring Training...	40
Aerobic and Anaerobic Fitness Qualities of Soccer Players	42

Training for Aerobic Capacity in Soccer.....	44
<i>Aerobic Endurance Training</i>	45
<i>Methods for Testing Aerobic Capacity in Soccer Players</i>	47
Tests Used to Evaluate and Monitor Adaptations in Football Players.....	49
<i>Field-based Maximal Tests</i>	50
Alternative Tests to Maximal Tests.....	52
<i>Submaximal Field-based Tests</i>	52
Summary of Literature Review.....	55
References	57
Chapter 3.....	64
Validity of the Session-RPE Method for Use with Women Soccer Players	64
Abstract	65
Introduction	66
Methods.....	69
Results.....	74
Discussion	77
References	81
Chapter 4.....	83
The Validity and Repeatability of Blood Lactate, RPE and Heart Rate Responses During the Sub-maximal Yo-Yo Intermittent Recovery Test for Use with Women Soccer Players	83
Abstract	84
Introduction	85
Methods.....	87
Results.....	91
Discussion	92
References	96
Chapter 5.....	97
The Practical Usefulness of a New Submaximal Test for Monitoring the Training Process in Women Soccer Players	97
Abstract	98
Introduction	100
Methods.....	102
Results.....	107
Discussion	108
References	113
Chapter 6.....	115

General Discussion, Conclusion, Recommendations and Future Research

Suggestions..... 115

 General Discussion..... 116

 Conclusion..... 119

 Recommendations..... 120

 Suggestions for Future Research 120

List of Figures and Tables

Chapter 2
Table 1: 39

Chapter 3
Table 1. 71
Table 2. 75
Table 3. 76
Figure 1. 77

Chapter 4
Table 1: 91

Chapter 5
Table 1: 103
Figure 1 105
Table 3 108

Abstract

The basis of the present thesis was to assess the validity and reliability of practical monitoring and testing tools that could be used by coaches, sport scientists and players to assist with the development and delivery of individualised training and periodisation programs, with the aim of achieving optimal performance. The aim of this research was to determine the utility of the session-RPE as a tool for monitoring training load (TL) in women's soccer and establish the efficacy of a submaximal Yo-Yo intermittent recovery test to assess aerobic training adaptations.

A major problem for coaches is being able to implement training programs that simultaneously meet the physical and technical/ tactical objectives of both the team and individuals within the team. Therefore, to overcome the limitations associated with team-based training, it has been suggested that a simple system which monitors an individual's training load (TL), and their response to their individual stimulus is required. Furthermore it is possible that if a valid and reliable test that was sensitive to changes in aerobic fitness adaptations was developed and then combined with measures of internal TL, an individual player's response to training could be monitored and the training process improved.

The purpose of the first study was to examine whether the session-RPE method for quantifying internal TL is a valid tool that can be used in women soccer players. The session-RPE, heart rate and session duration were recorded for individual

training sessions and matches over a period of 16 weeks. Session-RPE was then validated by correlation analysis with three commonly used HR-based methods for assessing TL.

The second study examined whether measurements of blood lactate, RPE and HR responses to the 6 min submaximal Yo-Yo intermittent recovery test Level 1 (Yo-Yo_{submax}) are repeatable and valid methods of monitoring aerobic adaptations in women soccer players. Ten elite players completed the following laboratory and field tests: maximal oxygen uptake ($\dot{V}O_{2\max}$), lactate threshold velocity (LTV), Multistage Fitness Test (MSFT) and Yo-Yo_{submax}. The test-retest reliability of a 6 min Yo-Yo_{submax} was completed by fourteen elite women players.

The third study assessed the sensitivity of physiological and perceptual responses following the 6 min Yo-Yo_{submax} test to markers of aerobic fitness. Nine elite women soccer players completed the MSFT before and after a 14 week early season soccer program. In addition, the players completed a Yo-Yo_{submax} test every four to five weeks during this period. The amount of change (Δ) in the blood lactate concentration [BLa], heart rate (HR) and rate of perceived exertion (RPE) responses from the Yo-Yo_{submax} test from the pre to post test occasions were correlated with the amount of change (Δ) in blood lactate, HR and RPE response from maximal field and laboratory-based treadmill tests. Furthermore, the same variables were correlated with training loads (TL) recorded over the 14 weeks.

The main finding in the first study was that the session-RPE method for monitoring TL was valid in women soccer players. Significant correlations were observed

across all training types and in particularly aerobic-based training sessions of a less-intermittent nature. In study two and three the validity, sensitivity and repeatability of a submaximal Yo-Yo intermittent recovery test was assessed for use with women soccer players. We found that the test had a moderate level of repeatability and that the physiological variables taken following the Yo-Yo_{submax} related to Multi-Stage Fitness Test (MSFT) performance but not to Lactate Threshold Velocity (LTV). The Yo-Yo_{submax} proved not to be a sensitive tool in assessing changes in aerobic capacity in elite women soccer players. Furthermore we found no correlation between Yo-Yo_{submax} variables and TL.

In conclusion, the results of the present studies suggest session-RPE may be a valid method for assessing internal TL for soccer players. Furthermore, Yo-Yo_{submax} may be a viable method for assessing aerobic capacities in soccer players. However, it is recommended that when this test is used to monitor soccer players, results are interpreted according to the test-retest coefficient of variation result provided in this study.

Keywords

Aerobic fitness

Blood lactate

Heart rate

Internal training load

Periodisation

Soccer training

Submaximal fitness test

Rating of Perceived Exertion

List of Abbreviations

1RM	One repetition max
[BLa]:RPE	Ratio of blood lactate to rating of perception of effort
CR 10	Category ratio scale
HR	Heart rate
HRmax	Maximal heart rate
HR:RPE	Ratio of heart rate to rating of perceived exertion
HR:[BLa]	Ratio of heart rate to blood lactate
LT	Lactate threshold
LTV	Lactate threshold velocity
LT _{zone}	Lactate threshold zone
LIST	Loughborough Intermittent Shuttle Test
MSFT	Multistage fitness test
OBLA	Onset of blood lactate accumulation
RPE	Rating of Perceived Exertion
TL	Training Load
TRIMP	Training Impulse
$\dot{V}O_{2max}$	Maximal oxygen consumption
Yo-Yo IR1	Yo-Yo intermittent recovery test level 1
Yo-Yo _{submax}	6min Yo-Yo intermittent recovery test level 1